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Applicant: IBIDEN CO LTD

[Title Of The Invention]

MANUFACTURE OF SEMICONDUCTOR PACKAGE

[Abstract]

PURPOSE: To improve the insulation reliability and quality stability of a semiconductor package by filling up through holes with solder grains from the sides opposite to the metallic pin inserting sides after the metallic pins are inserted into the holes and melting the solder grains by heating.

CONSTITUTION: After a wiring board is coated with an electroless-plated copper film having a thickness of $15\mu\text{m}$ by dipping the wiring board in an electroless plating solution for additive for 1 hours, a conductor circuit, through holes 3, and a die pad 5 are formed. Then metallic pins 9 are inserted into the holes 3 from the side opposite to the surface of the wiring board on which the die pad 5 is formed and, after solder grains of 0.15mm in diameter are supplied to the surface carrying the die pad, the holes 3 are filled up with the solder grains composed of Pb and Sn mixed at a ratio of Pb/Sn=6/4 by vibrating the wiring board with ultrasonic waves. Then the pins 9 are fixed to the holes 3 by reflowing the solder grains by heating the solder grains at $250+20^{\circ}\text{C}$ with a nitrogen flow. No bubble nor solder icicle is observed from the solder in the holes 3. In addition, the amounts of the solder in the holes 3 become uniform and no solder is left on the lands 4 of the holes 3.

[Claim(s)]

[Claim 1] In a manufacturing method of a semiconductor package which carries out soldering connection after forming a through hole in a substrate and inserting a metallic pin in the through hole, A manufacturing method of a semiconductor package which is made to fill up this through hole with two or more granular solder, and is characterized by the thing carrying out after baking fusion from an opposite hand with a side which inserted the metallic pin after inserting a metallic pin in a through hole.

[Claim 2] A manufacturing method of the semiconductor package according to claim 1 in which the diameter of said granular solder is 0.1-0.2 mm.

[Claim 3] By supplying granular solder to a substrates face of an opposite hand with a side which inserted the metallic pin, and subsequently giving vibration, after inserting a metallic pin in said through hole, A manufacturing method of the semiconductor package according to claim 1 which is made to fill up with this granular solder a gap constituted with a through hole wall and a metallic pin, and is characterized by the thing carrying out after baking fusion.

[Claim 4] In a manufacturing method of a semiconductor package which carries out soldering connection after forming a through hole in a substrate and inserting a metallic pin in the through hole, A manufacturing method of a semiconductor package which is made to arrange one grain of spherical solder to this through hole, and is characterized by the thing carrying out after baking fusion from an opposite hand with a side which inserted the metallic pin after inserting a metallic pin in a through hole.

[Claim 5] A manufacturing method of the semiconductor package according to claim 4

whose diameter of said spherical solder is 0.4-1.0 mm.

[Claim 6]After inserting a metallic pin in said through hole, with a side which inserted the metallic pin to a substrates face of an opposite hand. A manufacturing method of the semiconductor package according to claim 4 which sticks a mask in which an opening was provided in a position equivalent to this through hole, subsequently supplies spherical solder, is made to arrange spherical solder which penetrated an opening of this mask to this through hole, and is characterized by the thing carrying out after baking fusion.

[Detailed Description of the Invention]

[0001]

[Industrial Application]The invention in this application relates to the manufacturing method of the semiconductor package which was especially excellent in the connection reliability of a metallic pin and the through hole established in the substrate about the manufacturing method of what is called a PGA (Pin Grid Array) semiconductor package which has a metallic pin as an external terminal.

[0002]

[Description of the Prior Art]As general-purpose gestalt of a semiconductor package, there is a gestalt called what is called PGA. This is provided in the peripheral part of a substrate and has the structure to which the through hole electrically connected with the semiconductor part mounted in a substrate was made to insert and carry out soldering connection of the external terminal slack metallic pin. As for the soldering connection of a metallic pin and a through hole, in manufacturing such [conventionally] PGA, solder dip method, the heat melting (reflow) after soldering paste printing, and the method of cooling were adopted. A solder dip method is the method of covering the solder resist into the portion which does not carry out soldering connection among PGA boards, immersing this in melting solder, and subsequently cooling. The method of fills up soldering paste into the gap of a through hole and a metallic pin with screen-stencil etc., and are heat melting and a method of making it cool and performing soldering connection about this.

[0004]

[Problem(s) to be Solved by the Invention]However, in order that a solder amount and the solder shape may be uneven, and may immerse in melting solder for every through hole, may take this out and may cool in a method like soldering dip, The adhering solder flows and it becomes ice pillar-like, and in order to make between the circuits which must not have connection electric originally short-circuited, the fall of insulation reliability is caused. In a method like soldering paste, a solder amount is uneven for every through hole, and solder adheres thickly on surface pads, and it becomes a cause of a fall of mounting nature.

[0005]Thus, the method excellent in insulation reliability and the stability of quality is not conventionally proposed about the method of the soldering connection of a metallic pin and a through hole. The purpose of the invention in this application proposes the manufacturing method of the semiconductor package excellent in such insulation reliability and the stability of quality.

[0006]

[Means for Solving the Problem]In a manufacturing method of a semiconductor package which carries out soldering connection after the invention in this application forms a through hole in a substrate and inserting a metallic pin in the through hole, A

manufacturing method of a semiconductor package which is made to fill up this through hole with two or more granular solder, and is characterized by the thing [carrying out afterbaking fusion] from an opposite hand with a side which inserted the metallic pin after inserting a metallic pin in a through hole, In a manufacturing method of a semiconductor package which carries out soldering connection after forming a through hole in a substrate and inserting a metallic pin in the through hole, After inserting a metallic pin in a through hole, with a side which inserted the metallic pin, from an opposite hand, one grain of spherical solder is made to arrange to this through hole, and it is related with a manufacturing method of a semiconductor package, wherein the thing [carrying out afterbaking fusion]. The diameter of said granular solder is 0.10-0.20 mm. A diameter of said spherical solder is 0.4-1.0 mm. Granular solder or spherical solder differs from soldering paste. Soldering paste mixes detailed powder and resin of solder, a solvent, etc., and makes viscosity high, granular solder or spherical solder makes solder granular or spherical, and resin for raising viscosity is not added.

[0007]

[Function]After inserting a metallic pin in the through hole established in the substrate, two or more granular solder is made to fill up with the invention in this application into the through hole from an opposite hand, and the side which inserted the metallic pin needs the thing [carrying out afterbaking fusion] at it. Since it contains neither resin nor a solvent unlike soldering paste, other than the grain which entered the through hole, granular solder adheres to a substrate, or does not remain, and solder does not remain in the pad of a through hole, or it cannot do solder ice pillar. Since the granular solder amount with which a through hole is filled up is decided by the through hole and the gap constituted with a metallic pin, it becomes uniform [a solder amount]. Although solder is supplied into a through hole from the land of a through hole in a conventional method, since solder is supplied to the land of a through hole from the inside of a through hole, solder does not remain superfluously to a land by the method of the invention in this application. In order that a through hole and a metallic pin may perform nickel gilding, the clothing of the surface is carried out with gold, and it excels in wettability with solder, and the fused solder is transmitted in this golden clothing side, and is supplied to a through hole. A through hole is connected with a metallic pin by carrying out heat melting (what is called a reflow process) of this granular solder with which it filled up.

[0008]As for said granular solder, it is desirable for the diameter to be 0.10-0.20 mm. It is because a fill ration will not be stabilized to general-purpose through hole 0.55 mm in diameter if the reason gets solder blocked with less than 0.10 mm in a substrate face (places other than PGA), it is hard to slush and 0.20 mm is exceeded. By supplying granular solder to the substrates face of an opposite hand with the side which inserted the metallic pin, and subsequently giving vibration of an ultrasonic wave etc., after inserting a metallic pin in the through hole established in the substrate in the invention in this application, The gap constituted with a through hole wall and a metallic pin is made to fill up with this granular solder, and the thing [carrying out afterbaking fusion] is desirable. With the side which inserted the metallic pin, if granular solder is supplied to the substrates face of an opposite hand, granular solder will roll a substrates face and will fall in a through hole. Since the granular solder with which the excessive granular solder which exists in a substrates face by giving supersonic vibration was removed, and the through hole was filled up is arranged so that the closest packing may be carried out, A gap

is filled up efficiently, even when heat melting is carried out, air bubbles become difficult to remain, and reliable connection is attained.

[0009]In the manufacturing method of the semiconductor package which carries out soldering connection after another invention concerning this application forms a through hole in a substrate and inserting a metallic pin in the through hole, After inserting a metallic pin in a through hole, the side which inserted the metallic pin is a manufacturing method of the semiconductor package which drops one grain of spherical solder into the opening constituted with this through hole and a metallic pin, is made to arrange it from an opposite hand, and is characterized by the thing [carrying out afterbaking fusion]. Other than what was dropped into the opening constituted with a through hole and a metallic pin, and has been arranged, spherical solder adheres to a substrate, or does not remain, and solder does not remain in the pad of a through hole, or it cannot do solder ice pillar. Since the granular solder amount with which a through hole is filled up is decided by the size of spherical solder, it becomes uniform [a solder amount] and tends to adjust the quantity.

[0010]Although solder is supplied into a through hole from the land of a through hole in a conventional method, since solder is supplied to the land of a through hole from the inside of a through hole, solder does not remain superfluously to a land by the method of the invention in this application. In order that a through hole may perform nickel gilding, the clothing of the surface is carried out with gold, and it excels in wettability with solder, and the fused solder is transmitted in this golden clothing side, and is supplied to a land. A through hole is connected with a metallic pin by carrying out heat melting (what is called a reflow process) of this granular solder with which it filled up.

[0011]As for said granular solder, it is desirable for the diameter to be 0.4-1.0 mm. It is because spherical solder is no longer fixed to a hole if this range is decided to be a standard in general-purpose through hole 0.55 mm in diameter, its solder amount decreases in less than 0.4 mm and it exceeds 1.0 mm.

[0012]After inserting a metallic pin in the through hole formed in the substrate in the invention in this application, The mask in which the opening was provided in the position equivalent to this through hole is stuck to the substrates face of an opposite hand, subsequently spherical solder is supplied, this through hole or a metallic pin carries out contact arrangement of the spherical solder which penetrated the opening of this mask, and the thing [carrying out afterbaking fusion] of the side which inserted the metallic pin is desirable. This is because spherical solder once falls in the opening of a mask, a through hole is entered after that, so the supply arrangement of the spherical solder can be certainly carried out in a through hole.

[0013]The method of forming a through hole in a substrate in the invention in this application follows a conventional method. For example, in the ADETIBU method, the following processes are desirable.

- 1) Form the adhesives layer for nonelectrolytic plating for the adhesives for nonelectrolytic plating by methods, such as spreading or adhesive film lamination for nonelectrolytic plating, on a substrate. A glass epoxy board, a ceramic substrate, and copper and a heat dissipation nature board may be sufficient as a substrate. A substrate may be an insulating substrate in which the conductor circuit was formed.
- 2) The adhesives surface for nonelectrolytic plating is processed and roughened with acid or an oxidizer.
- 3) Make the hole for through hole formation with a drill. Hole dawn may be performed

before roughening treatment.

4) The catalyst for nonelectrolytic plating is given.

5) Form plating resist. plating resist laminates spreading or a photographic sensitive film for a photopolymer -- exposure development -- heat cure is carried out and it forms.

6) Nonelectrolytic plating is performed and a through hole is formed. At this time, the conductor circuit for connection between a through hole and the semiconductor part mounted is formed simultaneously.

7) Form a solder resist. A solder resist is a photopolymer containing coloring matter, such as Phthalocyanine Green.

This is applied, exposure development is carried out and a solder resist layer is formed.

[0014]As said adhesives for nonelectrolytic plating, the adhesives which distributed heat-resistant-resin impalpable powder have them to a resin matrix, and to it heat resistant resin powder, [desirable] Can use the thing of various shape, such as particle shape, hollow shape, and the shape of a piece of a crack, and especially in the case of particle shape, 1) A particle with a mean particle diameter of 10 micrometers or less, the floc which was made to condense heat resistant resin powder with 2 mean particle diameter of 2 micrometers or less, and was made into the size with a mean particle diameter of 2-10 micrometers, 3) The mixture of heat resistant resin powder with a mean particle diameter of 2-10 micrometers and heat resistant resin powder with a mean particle diameter of 2 micrometers or less, 4) Even if the surface of heat resistant resin powder with a mean particle diameter of 2-10 micrometers has little heat resistant resin powder with a mean particle diameter of 2 micrometers or less or inorganic powder with a mean particle diameter of 2 micrometers or less either, it is desirable to be chosen out of the pseudo grain to which make one sort come to adhere. When this reason exceeds the mean particle diameter of 10 micrometers, it is because an anchor becomes deep and it becomes impossible to form what is called a fine pattern below 100 μm , and on the other hand, the reason the false particles of the above 2-4 are desirable can form a complicated anchor, can raise peel strength. As a heat resistant resin matrix to be used, an epoxy resin, epoxy acrylate, etc. are good. As a heat resistant resin particle, amino resin, such as an epoxy resin and MERAMMI resin, is desirable.

[0015]As for the diameter of a through hole, in the invention in this application, it is desirable that it is a diameter of ± 0.2 mm of the pin of PGA. In the invention in this application, it is also possible to supply the solder for metallic pins simultaneously with flip chip mounting. As for this reason, since flip chip mounting is soldering connection, a simultaneous reflow becomes possible. The invention in this application is explained more to details using an example. The number in an example is a number of a drawing.

[0016]

[Example]

(Example 1)

(1) In accordance with the conventional method, the patchboard 1 which has a conductor circuit of three layers to both sides of a glass epoxy board was created (drawing 1).

(2) Into the alumina particle suspension which obtained 200 g of epoxy resin particles (the Toray Industries make, mean-particle-diameter 3.9 μm) by making it distribute in 5 l. of acetone, stirring within a Henschel mixer. By dropping the suspension obtained by making distribute 300 g of epoxy resin powder (the Toray Industries make, mean particle diameter of 0.5 micrometer) in the acetone solution in which the epoxy resin (product made from the Mitsui petrochemistry) was dissolved at a rate of 30 g to the acetone 1l, After making

epoxy powder adhere to the above-mentioned epoxy particle surface, the above-mentioned acetone is removed.

Then, it heated to 150 degrees C and false particles were created.

The mean particle diameter of this false particle is about 4.3. It is mum.

About 75 % of the weight existed in the range of ± 2 micrometers focusing on mean particle diameter.

[0017]The acrylic ghost of the cresol novolak type epoxy resin (Nippon Kayaku molecular weight 2500) which dissolved in DMDG 25% (3) 70 weight sections, polyether sulphone (PES) 30 weight section and an imidazole hardening agent (made in Shikoku Chemicals.) trade name: -- caprolactone conversion tris (AKUROKISHI ethyl) isocyanurate (the Toagosei make.) which is 2E4 MZ-CN4 weight section and a monomer made from sensitization Trade name; ARONIKKUSU M325 10 weight section, benzophenone (made by Kanto Kagaku) 5 weight section as a photoinitiator, a photosensitizer Michler's ketone (made by Kanto Kagaku) -- the epoxy resin false particles further created above (2) to this mixture 0.5 weight section, after mixing 40 weight sections, It mixed adding NMP, and the HOMODI spar agitator adjusted to viscosity 2000 CPS, then it kneaded with 3 rolls, and the photosensitive adhesives solution was obtained.

(4) After using and applying the roll coater on the patchboard which created this photosensitive adhesives solution above (1) and neglecting it for 20 minutes by the horizontal state, it dried at 60 degrees C.

[0018](5) The photomask film in which the black spot of 100 mumphi was printed was stuck to the patchboard which processed the above (4), and it exposed by ultrahigh pressure mercury lamp 500mj /cm². By carrying out spray development of this with a DMDG (diethylene glycol dimethyl ether) solution, the opening used as the viahole of 100 mumphi was formed on the patchboard (drawing 1 b). Said patchboard was exposed by about 3000 mj(s)/cm² with the ultrahigh pressure mercury lamp, and the resin layer indirect adhesive layer 2 with a thickness of 50 micrometers which has the opening which was excellent in the dimensional accuracy which is equivalent to a photomask film by [of 5 hours] heat-treating by 150 degrees C after that was formed by 100 degrees C for 1 hour.

(6) It was immersed in the potassium permanganate (KMnO₄, 60 g/l) which adjusted the patchboard which processed the above (5) to pH=13 for 15 minutes at 70 degrees C, and the surface of the resin insulating layer between layers was roughened, the roughened surface 4 was formed, and it ranked second, and after being immersed in the neutralized solution (product made from SHIPUREI), it rinsed.

(7) The palladium catalyst (product made from SHIPUREI) was given to the substrate which roughened the surface of the adhesives layer, and the surface of the adhesives layer 3 was activated.

[0019](8) Oligomer of the photosensitive grant which acrylic-ized 25% of the epoxy group of the cresol novolak type epoxy resin (Nippon Kayaku trade name EOCN-103S) dissolved in DMDG (dimethylglycol wood ether) (molecular weight 4000), PES (molecular weight 17000), an imidazole series hardening agent (Shikoku Chemicals trade name 2 PMHZ-PW), The acrylic-ized isocyanate which is a photosensitive monomer (Toagosei trade name ARONIKKUSU M215), After mixing using NMP by the following presentation, using benzophenone (made by Kanto Kagaku), and a photosensitizer

Michler's ketone (made by Kanto Kagaku) as a photoinitiator, it adjusted and kneaded to the viscosity of 3000 cps with 3 rolls continuously the HOMODI spar agitator, and liquid resist was obtained.

resin composition: -- photosensitive epoxy / PES/M325/BP/MK / imidazole

=70/30/10/5/0.5/5 (9) -- on the resin insulating layer of the above (7), used the roll coater, applied this liquid resist, it was made to dry at 60 degrees C, and the resist layer about 30 micrometers thick was formed (drawing 2).

[0020](10) The mask film in which the conductor circuit pattern of last shipment=50/50 was drawn was stuck to the patchboard which processed the above (9), and it exposed by ultrahigh pressure mercury lamp 1000 mJ/cm^2 . By carrying out the spray development of this by triethylene glycol wood ether (DMDG), the resist for plating from which the conductor circuit pattern part escaped was formed on the patchboard. Furthermore, with the ultrahigh pressure mercury lamp, it exposed by 6000 mJ/cm^2 and heat-treatment of 3 hours was performed at 150 degrees C after that at 100 degrees C for 1 hour. This plating resist is for forming the through hole 3 (0.6 mm in diameter), and pattern formation and the die pad 5.

(11) The patchboard of the above (10) was immersed in the electroless plating liquid for additives of the presentation shown below for 11 hours, non-electrolytic copper plating whose thickness of a plating film is 15 micrometers was performed, and the conductor circuit, the through hole 3, and the die pad 5 were formed.

[0021](12) The photosensitive oligomer which the epoxy group of cresol-novolak-type-epoxy-resin Nippon Kayaku make trade name EOCN-103S dissolved in DMDG acrylic-ized 25% (molecular weight 4000), PES (molecular weight 17000), an imidazole series hardening agent (Shikoku Chemicals trade name 2P4 MHZ-PW), The acrylic-ized isocyanate which is a photosensitive monomer (Toagosei trade name ARONIKKUSU M215), Using the benzophenone as a photoinitiator, photosensitizer MIHIRA (Kanto Kagaku), and colorant (Phthalocyanine Green), it mixed using NMP by the following presentation, and it adjusted and kneaded to the viscosity of 2000 cps with 3 rolls continuously the HOMODI spar agitator, and the liquefied solder resist was obtained.
resin composition: -- photosensitive epoxy / PES/M325/BP/MK / imidazole
=70/30/10/5/0.5/5 (13) -- on said patchboard, used the roll coater, applied this liquefied solder resist, it was made to dry at 60 degrees C, and the 20-micrometer-thick solder resist layer was formed.

[0022](14) The mask film in which the pattern that some die pads hid was drawn was stuck to the patchboard which processed the above (13), and it exposed. The spray development of this was carried out by diethylene-glycol diethylether (DMDG), and the opening 15 which the roughened surface formed on metallic pads exposes was formed. Furthermore, it exposed by 3000 mJ/cm^2 with the ultrahigh pressure mercury lamp, 150 degrees C performed heat-treatment of 3 hours after that at 100 degrees C for 1 hour, and the solder resist 6 was obtained (drawing 2).

(15) Nickel gilding was given to the through hole in accordance with the conventional method (not shown).

(16) The metallic pin 9 was inserted in the field opposite to the field in which the die pad 5 was formed (drawing 3), supersonic vibration was performed after supplying the granular solder 10 0.15 mm in diameter to the field in which the die pad 5 was formed (drawing 4), and it was filled up with the granular solder of Pb/Sn=6/4 (drawing 5 and an enlarged

drawing are shown in drawing 7).

[0023](17) Subsequently, a reflow was heated and carried out at 250 ± 20 degrees C by the nitrogen flow, and the metallic pin 9 was fixed to the through hole 3 (drawing 12 is indicated as drawing 6 and an enlarged drawing). Air bubbles were not seen by the solder 11 in a through hole, and a solder icicle was not observed, either. The solder amount in each through hole was also uniform. Survival of solder was not looked at by the land 4 of the through hole 3, either.

[0024](Example 2)

(1) The process to (1) - (15) of Example 1 was carried out.

(2) The mask in which an opening about 0.7 mm in diameter was provided in the position of the through hole 3 was stuck to the substrate.

(3) The spherical solder of Pb/Sn=9/1 0.6 mm in radius was supplied to the mask surface (drawing 8), and spherical solder was arranged in the through hole (drawing 9 and an enlarged drawing are indicated to drawing 11).

(4) Subsequently, a reflow was heated and carried out at 250 degrees C by the nitrogen flow, and the metallic pin 9 was fixed to the through hole 3 (drawing 12 is indicated as drawing 10 and an enlarged drawing). Air bubbles were not seen by the solder 11 in a through hole, and a solder icicle was not observed, either. The solder amount in each through hole was also uniform. Survival of solder was not looked at by the land 4 of the through hole 3, either.

[0025](Comparative example 1)

(1) The printed wired board was formed by the process of (1) - (15) of an example.

(2) After making this printed wired board dip into the solder bath to which melting of the solder of Pb/Sn=9/1 was carried out at 250 degrees C, this was taken out, it cooled to the room temperature, and the metallic pin 9 was fixed to the through hole 3 (drawing 13 is indicated as an enlarged drawing). Solder remained also in the land 4 and the metallic pin 9 of the through hole, and, as for the obtained product, dispersion was looked at by the solder amount of each through hole. The projection (solder icicle) of solder was seen at the tip of a metallic pin.

[0026](Comparative example 2)

(1) The printed wired board was formed by the process of (1) - (15) of an example.

(2) The solder cream of Pb/Sn=6/4 was printed to the land of the through hole, subsequently a reflow was heated and carried out at 235 degrees C, and the metallic pin 9 was fixed to the through hole 3 (drawing 14 is indicated as an enlarged drawing). Solder remained to the land 4 of the through hole, and, as for the obtained product, dispersion was looked at by the solder amount of each through hole.

[0027](Comparative example 3) Although this example was the same as that of Example 1 fundamentally, the particle diameter of granular solder was 0.05 mm. At this time, pads other than a PGA land had soldering arrival.

(Comparative example 4) Although this example was the same as that of Example 1 fundamentally, the particle diameter of granular solder was 0.25 mm. At this time, the fill ration had dispersion.

[0028](Comparative example 5) Although this example was the same as that of Example 2 fundamentally, the particle diameter of granular solder was 0.3 mm. At this time, two grains of spherical solder entered in the through hole, and dispersion was looked at by the fill ration.

(Comparative example 6) Although this example was the same as that of Example 2 fundamentally, the particle diameter of granular solder was 1.5 mm. At this time, there were too many solder amounts, and spherical solder was not fixed, but workability fell. [Effect of the Invention]The connection where does not have dispersion in a solder amount, either and solder ice pillar was not observed, either but which was excellent in reliability is above possible for the printed wired board of the invention in this application like explanation, without solder adhering to a metallic pin.

[Brief Description of the Drawings]

[Drawing 1]The first substrate concerning the manufacturing method of the invention in this application

[Drawing 2]The substrate with which the through hole concerning the manufacturing method of the invention in this application was formed

[Drawing 3]The substrate in which the through hole concerning the manufacturing method of the invention in this application was made to insert a metallic pin

[Drawing 4]Supply of the granular solder concerning the manufacturing method of the invention in this application

[Drawing 5]The substrate in the state where it was filled up with the granular solder concerning the manufacturing method of the invention in this application

[Drawing 6]The substrate in the state where a reflow of the granular solder concerning the manufacturing method of the invention in this application was carried out

[Drawing 7]The expanded sectional view of the substrate filled up with granular solder

[Drawing 8]The substrate in the state where a reflow of the spherical solder concerning the manufacturing method of the invention in this application was carried out

[Drawing 9]The substrate in the state where it was filled up with the spherical solder concerning the manufacturing method of the invention in this application

[Drawing 10]The substrate in the state where a reflow of the spherical solder concerning the manufacturing method of the invention in this application was carried out

[Drawing 11]The expanded sectional view of the substrate filled up with spherical solder

[Drawing 12]The expanded sectional view of the substrate after a reflow

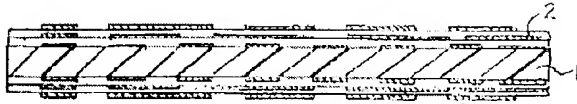
[Drawing 13]The expanded sectional view of the substrate obtained by the solder dip method

[Drawing 14]The expanded sectional view of the substrate obtained by screen printing

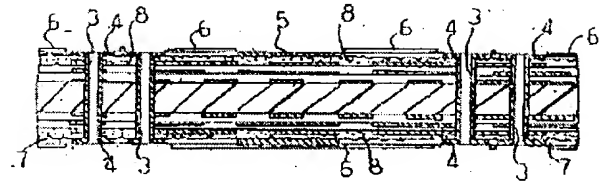
[Description of Notations]

- 1 Glass epoxy board
- 2 Conductor circuit
- 3 Through hole
- 4 The land of a through hole
- 5 Die pad
- 6 Solder resist
- 7 Plating resist
- 8 Adhesives layer
- 9 Metallic pin
- 10 Granular solder
- 11 Solder
- 12 Mask
- 13 Spherical solder

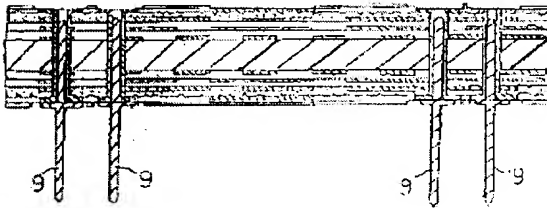
【図1】



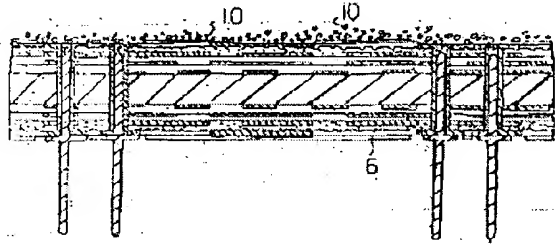
【図2】



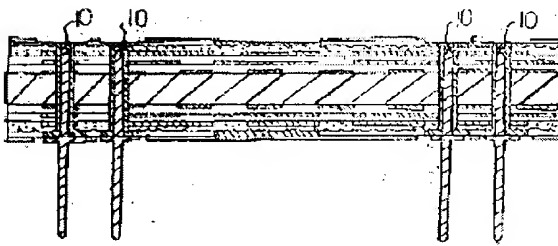
【図3】



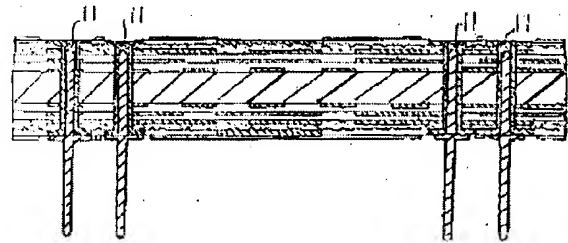
【図4】



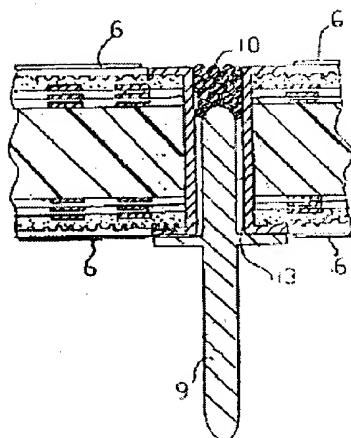
【図5】



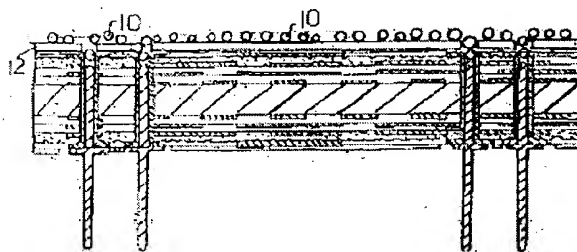
【図6】



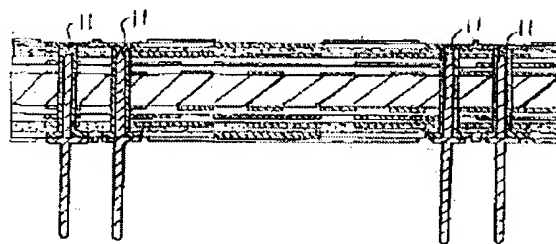
【图7】



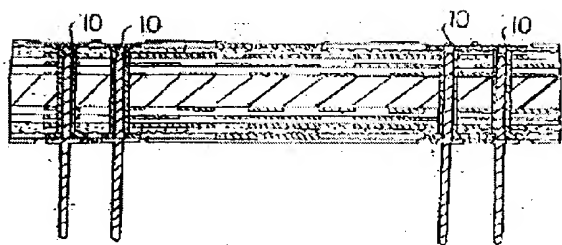
【图8】



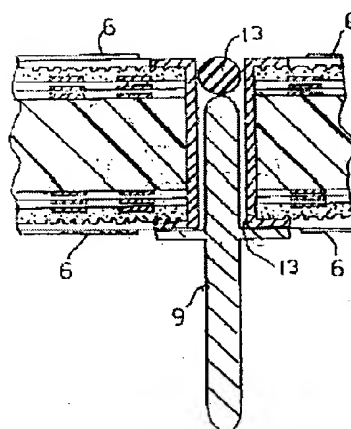
【图10】



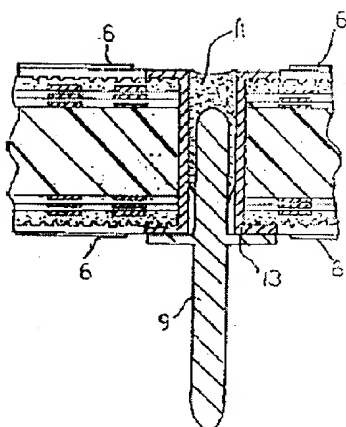
【图9】



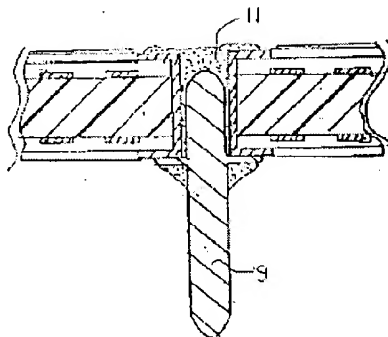
【图11】



【图12】



【图13】



【图14】

